PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2002-170852
(43)Date of publication of application : 14.06.2002

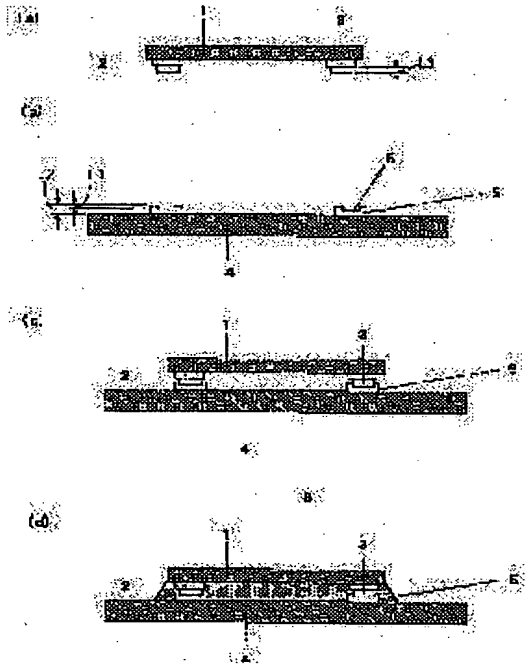
(51)Int.Cl. H01L 21/60
H05K 1/18
H05K 3/32
H05K 3/34

(21)Application number : 2000-366843
(22)Date of filing : 01.12.2000

(71)Applicant : MATSUSHITA ELECTRIC IND CO LTD
(72)Inventor : KUMANO YUTAKA
TOMURA YOSHIHIRO
ITAGAKI MINEHIRO

(54) MOUNTING METHOD AND MOUNTING BODY OF ELECTRONIC COMPONENT DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a mounting body of a reliable electronic component device.
SOLUTION: Dents 6 are formed in connection electrodes 5 on a circuit board 4, and a semiconductor device 1 is mounted on the board 4 so that all or some of the protruding electrodes 3 formed on a semiconductor device 1 are buried in the dents 6. Hereby, this structure is strong against a shear stress generating from the thermal expansion difference between the semiconductor device 1 and the circuit board 4 at high temperature, and against shear stress generating at high temperature, as each of the protruding electrodes 3 formed on the semiconductor device 1 is caught in each of dents 6 formed in connection electrodes 5 on a circuit board 4, shear distortion induced to shear stress is controlled and connection failures between the semiconductor device 1 and the circuit board 4 can be suppressed.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

2002-170852

MOUNTING METHOD AND MOUNTING BODY OF ELECTRONIC COMPONENT DEVICE

CLAIMS

[Claim(s)]

[Claim 1] The mounting approach of the electronic-parts component characterized by preparing beforehand said circuit board by which the wall was formed in the connection electrode in the mounting approach of the electronic-parts component which carries out flip chip mounting of the electronic-parts component, making the projection electrode of said electronic-parts component engage with said wall of the connection electrode of said circuit board, and connecting said connection electrode and said projection electrode to the circuit board electrically.

[Claim 2] The mounting approach of the electronic-parts component characterized by preparing beforehand said circuit board by which the depression was formed in the connection electrode in the mounting approach of the electronic-parts component which carries out flip chip mounting of the electronic-parts component, making the projection electrode of said electronic-parts component engage with said depression of the connection electrode of said circuit board, and connecting said connection electrode and said projection electrode to the circuit board electrically.

[Claim 3] The mounting approach of an electronic-parts component according to claim 1 or 2 of filling up with and stiffening closure resin between said electronic-parts component with which it connected electrically, and said circuit board.

[Claim 4] The mounting approach of an electronic-parts component according to claim 1 to 3 that the electroconductive glue layer is beforehand formed in said projection electrode electrically connected to said connection electrode.

[Claim 5] The mounting approach of an electronic-parts component according to claim 1 to 4 that the electroconductive glue layer is beforehand formed in said connection electrode electrically connected to said projection electrode.

[Claim 6] It is the mounting object characterized by forming a wall or a depression in the circuit board at the connection electrode of said circuit board in the mounting object of the electronic-parts component which comes to carry out flip chip mounting of the electronic-parts component, and, as for said electronic-parts component, having a projection electrode, and for said projection electrode engaging with said wall or said depression, and connecting with said connection electrode electrically.

[Claim 7] The mounting object according to claim 6 with which it fills up with closure resin between said circuit boards and said electronic-parts components.

[Claim 8] The mounting object according to claim 6 or 7 equipped with an electroconductive glue layer between said connection electrodes and said projection electrodes.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the mounting approach of the electronic-parts component which carries out especially flip chip mounting, and its mounting object about the mounting approach and mounting object of an electronic-parts component like a semiconductor device.

[0002]

[Description of the Prior Art] The method of using and mounting electroconductive glue in a connection in recent years as an approach of mounting a naked semiconductor device and the so-called bare chip directly on the circuit board is often used. That is, electroconductive glue is imprinted to the projection electrode beforehand formed on the terminal electrode of a semiconductor device, and it carries, after performing alignment so that it may be mounted in the predetermined connection electrode on the circuit board. Then, it is the approach of completing a mounting object, by stiffening electroconductive glue with curing oven, pouring closure resin into the gap of a semiconductor device and the circuit board, and stiffening the closure resin with curing oven further.

[0003] Hereafter, the mounting approach and mounting object of the conventional

semiconductor device are explained using drawing 5 . drawing 5 -- setting -- 1 -- a semiconductor device and 2 -- for the circuit board and 5, as for electroconductive glue and 8, the connection electrode of the circuit board 4 and 7 are [the terminal electrode of a semiconductor device 1, and 3 / a projection electrode and 4 / closure resin and 9] imprint pans.

[0004] As first shown in drawing 5 (a), the projection electrode 3 formed on the terminal electrode 2 of a semiconductor device 1 is made to dip in the electroconductive glue 7 controlled by thickness uniform on the imprint pan 9, and electroconductive glue 7 is imprinted to the projection electrode 3. Next, after performing alignment so that a semiconductor device 1 may be mounted in the position of the connection electrode 5 on the circuit board 4 as shown in drawing 5 (b), it carries by making it a face down. Subsequently, after stiffening electroconductive glue 7 by heating in oven for 120-degree C about 2 hours, liquefied closure resin will be poured into the gap of a semiconductor device 1 and the circuit board 4, and the mounting object of the semiconductor device shown in drawing 5 (c) will be acquired by heating for 150-degree C about 2 hours, and making it harden in oven.

[0005]

[Problem(s) to be Solved by the Invention] However, especially in such a conventional example, in the case of heat treatment for hardening of closure resin, it originates in the difference of the coefficient of thermal expansion of a semiconductor device 1 and the circuit board 4, shearing stress is mainly applied to the part of electroconductive glue 7, shearing strain occur, electroconductive glue 7 separates from the connection electrode 5 of the circuit board 4, or the projection electrode 3 of a semiconductor device 1, or a crack arises in electroconductive glue 7, and, for this reason, there is a difficulty that initial defective continuity occurs.

[0006] In order to raise productivity especially, when such a rapid temperature change that hardening of liquefied closure resin 8 does not catch up is given, since closure resin cannot be shared, the above-mentioned phenomenon of electroconductive glue 7 becomes remarkable about the shearing force resulting from the difference of the coefficient of thermal expansion of a semiconductor device 1 and the circuit board 4.

[0007] In addition, even if initial defective continuity is not seen, also when treating the mounting object of a semiconductor device at an elevated temperature after that, the same problem as the above has arisen.

[0008] In view of an above-mentioned point, it succeeds in this invention, and it aims at preventing the defective continuity who had arisen by the shearing strain resulting from the difference of the coefficient of thermal expansion of an electronic-parts

component and the circuit board, and raising connection dependability.

[0009]

[Means for Solving the Problem] It constitutes as follows that the above-mentioned technical problem should be solved in this invention.

[0010] That is, the mounting approach of the electronic-parts component of this invention prepares beforehand said circuit board by which the wall was formed in the circuit board at the connection electrode in the mounting approach of the electronic-parts component which carries out flip chip mounting of the electronic-parts component, makes the projection electrode of said electronic-parts component engage with said wall of the connection electrode of said circuit board, and connects said connection electrode and said projection electrode to it electrically.

[0011] Here, engagement includes the condition that a wall and a projection electrode contact or a projection electrode is inserted in the crevice divided by the wall that what is necessary is to say being involved, and for a wall and a projection electrode to change and just to break as ****.

[0012] Since according to this invention form a wall in the connection electrode of the circuit board, the projection electrode of an electronic-parts component is made to engage with said wall and it connects electrically, to the shearing stress resulting from the difference of the coefficient of thermal expansion of the electronic-parts component at the time of an elevated temperature, and the circuit board, it can become the firm structure by engagement to the step of a projection electrode and a connection electrode, shearing strain can be controlled, and the conventional defective continuity can be reduced.

[0013]

[Embodiment of the Invention] In the mounting approach of an electronic-parts component that invention of this invention according to claim 1 carries out flip chip mounting of the electronic-parts component at the circuit board Said circuit board by which the wall was formed in the connection electrode is prepared beforehand. To said wall of the connection electrode of said circuit board As opposed to the shearing stress which the projection electrode of said electronic-parts component is made engaged, connects said connection electrode and said projection electrode electrically, and originates in the difference of the coefficient of thermal expansion of the electronic-parts component at the time of an elevated temperature, and the circuit board Shearing strain can be controlled as firm structure by engagement to the wall of a projection electrode and a connection electrode.

[0014] In the mounting approach of an electronic-parts component that invention

according to claim 2 carries out flip chip mounting of the electronic-parts component at the circuit board Said circuit board by which the depression was formed in the connection electrode is prepared beforehand. To said depression of the connection electrode of said circuit board As opposed to the shearing stress which the projection electrode of said electronic-parts component is made engaged, connects said connection electrode and said projection electrode electrically, and originates in the difference of the coefficient of thermal expansion of the electronic-parts component at the time of an elevated temperature, and the circuit board Shearing strain can be controlled as firm structure by the insertion engagement to the depression of a projection electrode and a connection electrode.

[0015] The clearance can be filled up with closure resin, even if invention according to claim 3 fills up with and stiffens closure resin between said electronic-parts component with which it connected electrically, and said circuit board and a clearance is generated in the wall of a connection electrode, or a depression and the projection electrode of an electronic-parts component.

[0016] Even if the electroconductive glue layer is beforehand formed in said projection electrode electrically connected to said connection electrode and a clearance produces invention according to claim 4 in the wall of a connection electrode, or a depression and the projection electrode of an electronic-parts component, it will be placed between the clearances by electroconductive glue, and firm electrical installation will be obtained. Moreover, since connection of an electrode serves as adhesion from contact, if a mounting object with more stable high dependability can be acquired and electroconductive glue with still lower Young's modulus is used, it becomes the buffer layer which absorbs the shearing strain generated unavoidably, and the thermal fatigue life of a mounting object can be prolongation-of-life-ized.

[0017] Even if the electroconductive glue layer is beforehand formed in said connection electrode electrically connected to said projection electrode and a clearance produces invention according to claim 5 in the wall of a connection electrode, or a depression and the projection electrode of an electronic-parts component, it will be placed between the clearances by electroconductive glue, and firm electrical installation will be obtained. Moreover, since connection of an electrode serves as adhesion from contact, if a mounting object with more stable high dependability can be acquired and electroconductive glue with still lower Young's modulus is used, it becomes the buffer layer which absorbs the shearing strain generated unavoidably, and the thermal fatigue life of a mounting object can be prolongation-of-life-ized.

[0018] In the mounting object of an electronic-parts component with which invention of

this invention according to claim 6 comes to carry out flip chip mounting of the electronic-parts component at the circuit board to the connection electrode of said circuit board A wall or a depression is formed and said electronic-parts component has a projection electrode. Said projection electrode As opposed to the shearing stress which engages with said wall or said depression, is electrically connected to said connection electrode, and originates in the difference of the coefficient of thermal expansion of the electronic-parts component at the time of an elevated temperature, and the circuit board Shearing strain can be controlled as firm structure by the wall of the projection electrode of an electronic-parts component, and a connection electrode, or engagement to a depression.

[0019] Invention according to claim 7 can fill up the clearance with closure resin, even if it fills up with closure resin between said circuit boards and said electronic-parts components and a clearance is generated in the wall of a connection electrode, or a depression and the projection electrode of an electronic-parts component.

[0020] Even if invention according to claim 8 is equipped with the electroconductive glue layer between said connection electrodes and said projection electrodes and a clearance is generated in the wall of a connection electrode, or a depression and the projection electrode of an electronic-parts component, it will be placed between the clearances by electroconductive glue, and firm electrical installation will be obtained. Moreover, since connection of an electrode serves as adhesion from contact, if a mounting object with more stable high dependability can be acquired and electroconductive glue with still lower Young's modulus is used, it becomes the buffer layer which absorbs the shearing strain generated unavoidably, and the thermal fatigue life of a mounting object can be prolongation-of-life-ized.

[0021] Hereafter, the gestalt of operation of this invention is explained to a detail based on a drawing.

[0022] (Gestalt 1 of operation) Drawing 1 is the sectional view showing the process of the mounting approach of the semiconductor device concerning the gestalt 1 of operation of this invention, and gives the same reference mark to the part corresponding to the above-mentioned conventional example.

[0023] In this drawing, the projection electrode with which the semiconductor device as an electronic-parts component consists in 1, and a terminal electrode and 3 consist of gold etc. in 2, the connection electrode with which the circuit board and 5 consist of copper, nickel, etc. in 4, and 8 are closure resin.

[0024] With the gestalt of this operation, first, as shown in this drawing (a), the projection electrode 3 is formed in the terminal electrode 2 of a semiconductor device 1.

This projection electrode 3 is the metal electric conduction object formed with wire bond equipment, plating, etc.

[0025] On the other hand, as shown in this drawing (b), the circuit board 4 in which it dented in the connection electrode 5 and 6 was formed is prepared. This depression 6 is formed in the location where the projection electrode 3 of a semiconductor device 1 contacts.

[0026] This depression 6 can be formed by pressing an ingredient harder than the connection electrode 5, for example, a diamond, or can also be formed by the drill or laser.

[0027] Moreover, you may form in coincidence in the process of the circuit board 4. That is, the location where the projection electrode 3 contacts when forming wiring of the circuit board 4 by etching also removes wiring by etching to coincidence, the depression 6 is formed, or when forming wiring of the circuit board 4 by plating, by forming the resist in the location where the projection electrode 3 contacts, and barring metaled deposition, it dents in the connection electrode 3 and 6 is formed.

[0028] Next, it carries, after performing alignment so that it may be correctly mounted in the position of the circuit board 4 which is dented in the connection electrode 5 in the semiconductor device 1 in which the projection electrode 3 was formed, and has 6 as shown in this drawing (c).

[0029] That is, the projection electrode 3 of a semiconductor device 1 is inserted in and carried in the depression 6 of the connection electrode 5 of the circuit board 4 with the gestalt of engagement and this implementation.

[0030] For this reason, as for the path of the circular depression 6, it is desirable that it is same or, a little large extent as the outer diameter of the projection electrode 3. This desirable reason is that it becomes firmer structure to shearing force by [dent and the play of is almost lost between 6] having been given to the projection electrode 3 and the connection electrode 5.

[0031] Moreover, it dents, and it is the about thickness [less than] L2 of wiring of the circuit board 4, for example, 20 micrometers, at the maximum, and, as for the die length L3 of the projection electrode 3, it is desirable [the depth L1 of 6] that is more than it for having been given to the connection electrode 5. It will dent, a clearance will exist in 6 and this desirable reason is from **** about the danger given to the connection electrode 5 that this clearance will have a bad influence on the dependability of a mounting object, when [which it dented, and inserted the projection electrode 3 in the depression 6 when shorter than the depth L1 of 6] the die length L3 of the projection electrode 3 is given to the connection electrode 5. Moreover, in case a

clearance can turn into space in which humidity is stored, for example, solder mounting of the semiconductor device mounting object is carried out at a mother substrate, a phreatic explosion may be caused with the heat of a reflow.

[0032] When are given to the path of the projection electrode 3, and the connection electrode 5, and both deform the one among the ingredient of the projection electrode 3, and the ingredient of the connection electrode 5 where which or a degree of hardness is lower at the time of projection electrode 3 loading, a path is made in agreement and it can consider [whose path of 6 dent and does not correspond] as firmer structure to shearing force.

[0033] Next, as shown in this drawing (d), closure resin 8 is poured into the gap of a semiconductor device 1 and the circuit board 4, for example, 150 degrees C is stiffened in about 2 hours.

[0034] The approach which applies closure resin beforehand not only an above-mentioned side flow but on the circuit board 4, extends closure resin 8 at the time of loading of a semiconductor device 1, and is filled up with a both gap, and the so-called compression flow are sufficient as the restoration approach of closure resin 8 here. Moreover, closure resin 8 may not be liquefied and the so-called solid of B stage is sufficient as it.

[0035] Here, when [to which it dents and a clearance exists in 6] given to the connection electrode 5, it is desirable to make closure resin 8 also permeate the clearance. This desirable reason is that the play between the depressions 6 given to the projection electrode 3 and the connection electrode 5 is lost, and it becomes firmer structure to shearing force.

[0036] Thus, since the depression 6 of the connection electrode 5 of the circuit board 4 is made to carry out insertion engagement and the projection electrode 3 of a semiconductor device 1 is carried in it As opposed to the shearing stress which originates in the difference of the coefficient of thermal expansion of the semiconductor device 1 in the case of heat treatment for hardening of closure resin 8, and the circuit board 4 especially The firm structure by insertion by the depression 6 of the projection electrode 3 and the connection electrode 5 can control shearing strain, can reduce the defective continuity who had arisen conventionally by this, and can raise connection dependability.

[0037] (Gestalt 2 of operation) Drawing 2 is a sectional view corresponding to drawing 1 for explaining the mounting approach concerning the gestalt of other operations of this invention, and gives the same reference mark to the part corresponding to drawing 1.

[0038] With the gestalt of this operation, first, as shown in this drawing (a), the projection electrode 3 is formed in the terminal electrode 2 of a semiconductor device 1. This projection electrode 3 is the metal electric conduction object formed with wire bond equipment, plating, etc.

[0039] On the other hand, as shown in this drawing (b), the circuit board 4 in which it dented in the location where the projection electrode 3 of the connection electrode 5 contacts, and 6 was formed is prepared. Furthermore, electroconductive glue 7 is embedded by printing etc. in the depression 6.

[0040] Next, as shown in this drawing (c), perform alignment so that it may be correctly mounted in the position of the circuit board 4 which is dented in the connection electrode 5 in the semiconductor device 1 in which the projection electrode 3 was formed, and has 6, namely, the projection electrode 3 of a semiconductor device 1 is made to get into the depression 6 of the connection electrode 5 of the circuit board 4, and it carries.

[0041] With the gestalt of this operation, when are given to the path of the projection electrode 3, and the connection electrode 5, and electroconductive glue 7 deforms at the time of projection electrode 3 loading, electroconductive glue 7 enters the clearance by the difference of a path, and it becomes [whose path of 6 dent and does not correspond] firmer structure to shearing force.

[0042] Next, as shown in this drawing (d), closure resin 8 is poured into the gap of a semiconductor device 1 and the circuit board 4, for example, 150 degrees C is stiffened in about 2 hours.

[0043] Other configurations and effectiveness are the same as the gestalt 1 of above-mentioned operation.

[0044] (Gestalt 3 of operation) Drawing 3 is a sectional view corresponding to drawing 1 for explaining the mounting approach concerning the gestalt of other operations of this invention, and gives the same reference mark to the part corresponding to drawing 1.

[0045] With the gestalt of this operation, first, as shown in this drawing (a), the projection electrode 3 is formed in the terminal electrode 2 of a semiconductor device 1. This projection electrode 3 is the metal electric conduction object formed with wire bond equipment, plating, etc. Furthermore, the layer of electroconductive glue 7 is formed in that front face at this projection electrode 3.

[0046] On the other hand, as shown in this drawing (b), the circuit board 4 in which it dented in the location where the projection electrode 3 of the connection electrode 5 contacts, and 6 was formed is prepared.

[0047] Next, as shown in this drawing (c), perform alignment so that it may be correctly mounted in the position of the circuit board 4 which is dented in the connection electrode 5 in the semiconductor device 1 in which the projection electrode 3 was formed, and has 6, namely, the projection electrode 3 of a semiconductor device 1 is made to get into the depression 6 of the connection electrode 5 of the circuit board 4, and it carries.

[0048] With the gestalt of this operation, when are given to the path of the projection electrode 3, and the connection electrode 5, and electroconductive glue 7 deforms at the time of projection electrode 3 loading, electroconductive glue 7 enters the clearance by the difference of a path, and it becomes [whose path of 6 dent and does not correspond] firmer structure to shearing force.

[0049] Next, as shown in this drawing (d), closure resin 8 is poured into the gap of a semiconductor device 1 and the circuit board 4, for example, 150 degrees C is stiffened in about 2 hours.

[0050] Other configurations and effectiveness are the same as the gestalt 1 of above-mentioned operation.

[0051] (Gestalt 4 of operation) Drawing 4 is a sectional view corresponding to drawing 1 for explaining the mounting approach concerning the gestalt of other operations of this invention, and gives the same reference mark to the part corresponding to drawing 1.

[0052] With the gestalt of this operation, first, as shown in this drawing (a), the projection electrode 3 is formed in the terminal electrode 2 of a semiconductor device 1. This projection electrode 3 is the metal electric conduction object formed with wire bond equipment, plating, etc. Furthermore, the layer of electroconductive glue 7 is formed in that front face at this projection electrode 3.

[0053] On the other hand, as shown in this drawing (b), the circuit board 4 in which it dented in the location where the projection electrode 3 of the connection electrode 5 contacts, and 6 was formed is prepared beforehand, and electroconductive glue 7 is embedded further in the depression 6.

[0054] Next, as shown in this drawing (c), perform alignment so that it may be correctly mounted in the position of the circuit board 4 which is dented in the connection electrode 5 in the semiconductor device 1 in which the projection electrode 3 was formed, and has 6, namely, the projection electrode 3 of a semiconductor device 1 is made to get into the depression 6 of the connection electrode 5 of the circuit board 4, and it carries.

[0055] With the gestalt of this operation, when are given to the path of the projection

electrode 3, and the connection electrode 5, and the projection electrode 3 or the electroconductive glue 7 of a depression 6 deforms at the time of projection electrode 3 loading, electroconductive glue 7 enters the clearance by the difference of a path, and it becomes [whose path of 6 dent and does not correspond] firmer structure to shearing force.

[0056] Next, as shown in this drawing (d), closure resin 8 is poured into the gap of a semiconductor device 1 and the circuit board 4, for example, 150 degrees C is stiffened in about 2 hours.

[0057] Other configurations and effectiveness are the same as the gestalt 1 of above-mentioned operation.

[0058] (Gestalt of other operations) With the gestalt of each above-mentioned operation, although the projection electrode 3 was one step of projection, as a gestalt of other operations of this invention, projection electrodes may be two steps of projections like the conventional example of drawing 5 , and it should just form in the connection electrode of the circuit board the depression or wall which engages with the projection at a tip in this case.

[0059] With the gestalt of each above-mentioned operation, also although a depression 6 should form, a wall which replaces with a depression 6, carries out contact engagement at a part of peripheral wall [at least] of the projection electrode 3, and resists shearing stress as a gestalt of other operations of this invention may be formed in the connection electrode 5. That is, a wall can follow a hoop direction and can grasp a depression 6 as what was continued and formed in the perimeter. Moreover, a wall may penetrate the connection electrode 5, may result in the circuit board 6, considers as the through tube which penetrates the connection electrode 5 for a depression 6, and is good also considering the wall as a wall.

[0060] In addition, this invention is applicable not only to mounting of a semiconductor device but mounting of other electronic-parts components which carries out bare chip mounting like an SAW filter.

[0061]

[Effect of the Invention] As mentioned above, according to this invention, to the shearing stress resulting from the difference of the coefficient of thermal expansion of the electronic-parts component at the time of an elevated temperature, and the circuit board, shearing strain can be controlled as firm structure by the wall of a projection electrode and a connection electrode, or engagement to a depression, the conventional defective continuity who had arisen by the shearing strain which originate in the difference of the coefficient of thermal expansion of an electronic-parts component and

the circuit board by this can be reduced, and connection dependability can be raised.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the sectional view of the mounting process of the semiconductor device concerning the gestalt 1 of operation of this invention.

[Drawing 2] It is the sectional view of the mounting process of the semiconductor device concerning the gestalt 2 of operation of this invention.

[Drawing 3] It is the sectional view of the mounting process of the semiconductor device concerning the gestalt 3 of operation of this invention.

[Drawing 4] It is the sectional view of the mounting process of the semiconductor device concerning the gestalt 4 of operation of this invention.

[Drawing 5] It is the sectional view of the mounting process of the conventional semiconductor device.

[Description of Notations]

1 Semiconductor Device
2 Terminal Electrode
3 Projection Electrode
4 Circuit Board
5 Connection Electrode
6 Depression
7 Electroconductive Glue
8 Closure Resin

Abstract:

PROBLEM TO BE SOLVED: To provide a mounting body of a reliable electronic component device.

SOLUTION: Dents 6 are formed in connection electrodes 5 on a circuit board 4, and a semiconductor device 1 is mounted on the board 4 so that all or some of the protruding electrodes 3 formed on a semiconductor device 1 are buried in the dents 6. Hereby, this structure is strong against a shear stress generating from the thermal expansion difference between the semiconductor device 1 and the circuit board 4 at high temperature, and against shear stress generating at high temperature, as each of the protruding electrodes 3 formed on the semiconductor device 1 is caught in each of dents 6 formed in connection electrodes 5 on a circuit board 4, shear distortion induced to shear stress is controlled and connection failures between the semiconductor device 1 and the circuit board 4 can be suppressed.

[Translation done.]

(19)日本国特許庁（ＪＰ）　(12) **公開特許公報（Ａ）**　(11)特許出願公開番号
特開2002－170852
（P2002－170852A）
(43)公開日　平成14年６月14日(2002.6.14)

(51)Int.Cl.'	識別記号	ＦＩ		テーマコード'（参考）
Ｈ０１Ｌ　21/60	３１１	Ｈ０１Ｌ　21/60	３１１Ｓ	５Ｅ３１９
		Ｈ０５Ｋ　1/18	Ｌ	５Ｅ３３６
Ｈ０５Ｋ　1/18		3/32	Ｂ	５Ｆ０４４
3/32		3/34	５０１Ｅ	
3/34	５０１	Ｈ０１Ｌ　21/92	６０２Ｒ	

審査請求　未請求　請求項の数８　ＯＬ　（全　８　頁）　最終頁に続く

(21)出願番号　特願2000－366843(P2000－366843)

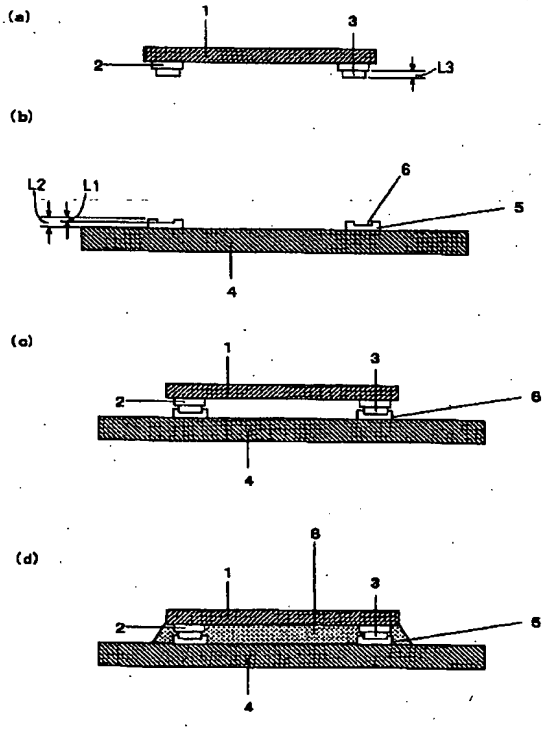
(22)出願日　平成12年12月１日(2000.12.1)

(71)出願人　000005821
松下電器産業株式会社
大阪府門真市大字門真1006番地
(72)発明者　熊野　豊
大阪府門真市大字門真1006番地　松下電器産業株式会社内
(72)発明者　戸村　善広
大阪府門真市大字門真1006番地　松下電器産業株式会社内
(74)代理人　100086737
弁理士　岡田　和秀

最終頁に続く

(54)【発明の名称】　電子部品素子の実装方法およびその実装体

(57)【要約】
【課題】信頼性の高い電子部品素子の実装体を提供する。
【解決手段】回路基板４上の接続電極５に凹み６を施し、その凹み６に半導体素子１に形成された突起電極３が全部もしくは一部埋め込められるように実装する。これにより高温時の半導体素子１と回路基板４の熱膨張係数の差により発生するせん断応力に対し、強固な構造となり、高温時に発生するせん断応力にに対し、回路基板４上の接続電極５に形成された凹み６に、半導体素子１に形成された突起電極３が引っかかり、せん断応力に誘起されるせん断歪みを抑え、半導体素子１と回路基板４間の導通不良を抑制する。



【特許請求の範囲】
【請求項１】　回路基板に、電子部品素子をフリップチップ実装する電子部品素子の実装方法において、
接続電極に壁部が形成された前記回路基板を予め準備し、
前記回路基板の接続電極の前記壁部に、前記電子部品素子の突起電極を係合させて前記接続電極と前記突起電極とを電気的に接続することを特徴とする電子部品素子の実装方法。
【請求項２】　回路基板に、電子部品素子をフリップチップ実装する電子部品素子の実装方法において、
接続電極に凹みが形成された前記回路基板を予め準備し、
前記回路基板の接続電極の前記凹みに、前記電子部品素子の突起電極を係合させて前記接続電極と前記突起電極とを電気的に接続することを特徴とする電子部品素子の実装方法。
【請求項３】　電気的に接続された前記電子部品素子と前記回路基板との間に、封止樹脂を充填して硬化させる請求項１または２記載の電子部品素子の実装方法。
【請求項４】　前記接続電極に電気的に接続される前記突起電極には、予め導電性接着剤層が形成されている請求項１ないし３のいずれかに記載の電子部品素子の実装方法。
【請求項５】　前記突起電極に電気的に接続される前記接続電極には、予め導電性接着剤層が形成されている請求項１ないし４のいずれかに記載の電子部品素子の実装方法。
【請求項６】　回路基板に、電子部品素子をフリップチップ実装してなる電子部品素子の実装体において、
前記回路基板の接続電極には、壁部または凹みが形成され、前記電子部品素子は突起電極を有し、前記突起電極は、前記壁部または前記凹みに係合して前記接続電極に電気的に接続されることを特徴とする実装体。
【請求項７】　前記回路基板と前記電子部品素子との間には、封止樹脂が充填される請求項６記載の実装体。
【請求項８】　前記接続電極と前記突起電極との間に、導電性接着剤層を備える請求項６または７記載の実装体。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、半導体素子のような電子部品素子の実装方法とその実装体に関し、特にフリップチップ実装する電子部品素子の実装方法およびその実装体に関する。
【０００２】
【従来の技術】裸の半導体素子、いわゆるベアチップを回路基板上に直接実装する方法として、近年接続部に導電性接着剤を用いて実装する方法がしばしば用いられている。すなわち、予め半導体素子の端子電極上に形成された突起電極に導電性接着剤を転写し、回路基板上の所定の接続電極に実装されるよう位置合わせを行った後、搭載する。続いて硬化炉で導電性接着剤を硬化させ、半導体素子と回路基板の間隙に封止樹脂を注入し、さらにその封止樹脂を硬化炉にて硬化させることにより実装体を完成させるという方法である。
【０００３】以下、従来の半導体素子の実装方法とその実装体を、図５を用いて説明する。図５において、１は半導体素子、２は半導体素子１の端子電極、３は突起電極、４は回路基板、５は回路基板４の接続電極、７は導電性接着剤、８は封止樹脂、９は転写皿である。
【０００４】まず図５（ａ）に示されるように、半導体素子１の端子電極２上に形成された突起電極３を、転写皿９上に均一な厚さに制御された導電性接着剤７に浸積させ、突起電極３に導電性接着剤７を転写する。次に、図５（ｂ）に示されるように、半導体素子１を、回路基板４上の接続電極５の所定の位置に実装されるように位置合わせを行った後、フェースダウンにして搭載する。ついで、１２０℃２時間ほどオーブンで加熱することにより、導電性接着剤７を硬化させた後、半導体素子１と回路基板４との間隙に液状の封止樹脂を注入し、オーブン中で１５０℃２時間ほど加熱し、硬化させることにより、図５（ｃ）に示される半導体素子の実装体が得られることになる。
【０００５】
【発明が解決しようとする課題】しかしながら、このような従来例では、特に封止樹脂の硬化のための熱処理の際に、半導体素子１と回路基板４との熱膨張係数の差に起因して、主に導電性接着剤７の部分にせん断応力がかかってせん断歪みが発生し、導電性接着剤７が、回路基板４の接続電極５あるいは半導体素子１の突起電極３から剥がれたり、導電性接着剤７にクラックが生じ、このため、初期導通不良が発生するという難点がある。
【０００６】特に、生産性を高めるために、液状の封止樹脂８の硬化が追いつかないほど急激な温度変化を与えたときには、半導体素子１と回路基板４との熱膨張係数の差に起因するせん断力を、封止樹脂が分担できないために、導電性接着剤７の上記現象は、顕著となる。
【０００７】なお、初期導通不良が見られなくても、その後高温にて半導体素子の実装体を扱うときにも、上記と同じ問題が生じている。
【０００８】本発明は、上述の点に鑑みて為されたものであって、電子部品素子と回路基板との熱膨張係数の差に起因するせん断歪みによって生じていた導通不良を防止して接続信頼性を高めることを目的とする。
【０００９】
【課題を解決するための手段】本発明においては上記課題を解決すべく、次のように構成している。
【００１０】すなわち、本発明の電子部品素子の実装方法は、回路基板に、電子部品素子をフリップチップ実装

する電子部品素子の実装方法において、接続電極に壁部が形成された前記回路基板を予め準備し、前記回路基板の接続電極の前記壁部に、前記電子部品素子の突起電極を係合させて前記接続電極と前記突起電極とを電気的に接続するものである。

【００１１】ここで、係合とは、かかわり合うことをいい、壁部と突起電極とがかわり合わっておればよく、例えば、壁部と突起電極とが当接したり、壁部で区画された凹部に突起電極が嵌め込まれたりする状態を含むものである。

【００１２】本発明によると、回路基板の接続電極に壁部を形成し、電子部品素子の突起電極を、前記壁部に係合させて電気的に接続するので、高温時の電子部品素子と回路基板との熱膨張係数の差に起因するせん断応力に対して、突起電極と接続電極の段部との係合による強固な構造となり、せん断歪みを抑制して従来の導通不良を低減することができる。

【００１３】

【発明の実施形態】本発明の請求項１に記載の発明は、回路基板に、電子部品素子をフリップチップ実装する電子部品素子の実装方法において、接続電極に壁部が形成された前記回路基板を予め準備し、前記回路基板の接続電極の前記壁部に、前記電子部品素子の突起電極を係合させて前記接続電極と前記突起電極とを電気的に接続するものであり、高温時の電子部品素子と回路基板との熱膨張係数の差に起因するせん断応力に対して、突起電極と接続電極の壁部との係合による強固な構造としてせん断歪みを抑制することができる。

【００１４】請求項２に記載の発明は、回路基板に、電子部品素子をフリップチップ実装する電子部品素子の実装方法において、接続電極に凹みが形成された前記回路基板を予め準備し、前記回路基板の接続電極の前記凹みに、前記電子部品素子の突起電極を係合させて前記接続電極と前記突起電極とを電気的に接続するものであり、高温時の電子部品素子と回路基板との熱膨張係数の差に起因するせん断応力に対して、突起電極と接続電極の凹みとの嵌め込み係合による強固な構造としてせん断歪みを抑制することができる。

【００１５】請求項３に記載の発明は、電気的に接続された前記電子部品素子と前記回路基板との間に、封止樹脂を充填して硬化させるものであり、接続電極の壁部あるいは凹みと電子部品素子の突起電極とに隙間が生じても、その隙間に封止樹脂を充填できることになる。

【００１６】請求項４に記載の発明は、前記接続電極に電気的に接続される前記突起電極には、予め導電性接着剤層が形成されており、接続電極の壁部あるいは凹みと電子部品素子の突起電極とに隙間が生じても、その隙間に導電性接着剤が介在して強固な電気的接続が得られることになる。また、電極の接続が、接触から接着となるため、より安定な信頼性の高い実装体を得ることができ、さらに、ヤング率の低い導電性接着剤を用いれば、やむを得ず発生するせん断歪みを吸収するバッファー層となり、実装体の熱疲労寿命を延命化することができる。

【００１７】請求項５に記載の発明は、前記突起電極に電気的に接続される前記接続電極には、予め導電性接着剤層が形成されており、接続電極の壁部あるいは凹みと電子部品素子の突起電極とに隙間が生じても、その隙間に導電性接着剤が介在して強固な電気的接続が得られることになる。また、電極の接続が、接触から接着となるため、より安定な信頼性の高い実装体を得ることができ、さらに、ヤング率の低い導電性接着剤を用いれば、やむを得ず発生するせん断歪みを吸収するバッファー層となり、実装体の熱疲労寿命を延命化することができる。

【００１８】本発明の請求項６に記載の発明は、回路基板に、電子部品素子をフリップチップ実装してなる電子部品素子の実装体において、前記回路基板の接続電極には、壁部または凹みが形成され、前記電子部品素子は突起電極を有し、前記突起電極は、前記壁部または前記凹みに係合して前記接続電極に電気的に接続されるものであり、高温時の電子部品素子と回路基板との熱膨張係数の差に起因するせん断応力に対して、電子部品素子の突起電極と、接続電極の壁部または凹みとの係合による強固な構造としてせん断歪みを抑制することができる。

【００１９】請求項７に記載の発明は、前記回路基板と前記電子部品素子との間には、封止樹脂が充填されるものであり、接続電極の壁部あるいは凹みと電子部品素子の突起電極とに隙間が生じても、その隙間に封止樹脂を充填できることになる。

【００２０】請求項８に記載の発明は、前記接続電極と前記突起電極との間に、導電性接着剤層を備えており、接続電極の壁部あるいは凹みと電子部品素子の突起電極とに隙間が生じても、その隙間に導電性接着剤が介在して強固な電気的接続が得られることになる。また、電極の接続が、接触から接着となるため、より安定な信頼性の高い実装体を得ることができ、さらに、ヤング率の低い導電性接着剤を用いれば、やむを得ず発生するせん断歪みを吸収するバッファー層となり、実装体の熱疲労寿命を延命化することができる。

【００２１】以下、図面に基づいて、本発明の実施の形態について詳細に説明する。

【００２２】（実施の形態１）図１は、本発明の実施の形態１に係る半導体素子の実装方法の工程を示す断面図であり、上述の従来例に対応する部分には、同一の参照符号を付す。

【００２３】同図において、１は電子部品素子としての半導体素子、２は端子電極、３は、例えば、金などからなる突起電極、４は回路基板、５は、例えば、銅およびニッケルなどからなる接続電極、８は封止樹脂である。

【００２４】この実施の形態では、先ず、同図（ａ）のように、半導体素子１の端子電極２に突起電極３を形成する。この突起電極３は、ワイヤボンド装置やめっきなどで形成された金属導電物である。

【００２５】一方、同図（ｂ）のように、接続電極５に凹み６が形成された回路基板４を準備する。この凹み６は、半導体素子１の突起電極３が当接する位置に形成されている。

【００２６】この凹み６は、接続電極５よりも硬い材料、例えば、ダイヤモンドを押し当てることによって形成することができ、あるいは、ドリルやレーザーで形成することもできる。

【００２７】また、回路基板４のプロセスで同時に形成してもよい。すなわち、回路基板４の配線をエッチングにより形成する場合、突起電極３が当接する位置も同時にエッチングにより配線を取り除き、凹み６を形成しておく、あるいは、回路基板４の配線をメッキで形成する場合、突起電極３が当接する位置に、レジストを形成しておき、金属の堆積を妨げることによって、接続電極３に凹み６を形成するのである。

【００２８】次に、同図（ｃ）に示されるように、突起電極３の形成された半導体素子１を、接続電極５に凹み６を有する回路基板４の所定の位置に正確に実装されるよう位置合わせを行なった後、搭載する。

【００２９】すなわち、半導体素子１の突起電極３を、回路基板４の接続電極５の凹み６に、係合、この実施の形態では、嵌め込んで搭載するのである。

【００３０】このため、円形の凹み６の径は、突起電極３の外径と同じあるいはやや大きい程度であるのが好ましい。かかる好ましい理由は、突起電極３と接続電極５に施された凹み６との間に遊びがほとんどなくなることにより、せん断力に対してより強固な構造となるからである。

【００３１】また、接続電極５に施された凹み６の深さＬ１は、最大でも回路基板４の配線の厚みＬ２、例えば、２０μｍ程度以下であり、突起電極３の長さＬ３はそれ以上であるのが好ましい。かかる好ましい理由は、突起電極３の長さＬ３が接続電極５に施された凹み６の深さＬ１よりも短い場合、突起電極３を、凹み６に嵌め込んだときに、接続電極５に施された凹み６に隙間が存在することとなり、この隙間は実装体の信頼性に悪影響を及ぼす危険性を孕むからである。また、隙間は、湿度が貯蔵される空間となり得、例えば、半導体素子実装体を、マザー基板にはんだ実装する際、リフローの熱により水蒸気爆発を起こす可能性がある。

【００３２】突起電極３の径と接続電極５に施された凹み６の径が一致しない場合、突起電極３搭載時において、突起電極３の材料と接続電極５の材料のうち、どちらか硬度の低い方、もしくは両方が変形することにより、径を一致させて、せん断力に対してより強固な構造とすることができる。

【００３３】次に、同図（ｄ）に示されるように、半導体素子１と回路基板４との間隙に封止樹脂８を注入し、例えば、１５０℃２時間程度で硬化させる。

【００３４】ここで封止樹脂８の充填方法は、上述のサイドフローに限らず、回路基板４上に予め封止樹脂を塗布しておき、半導体素子１の搭載時に封止樹脂８を押し広げ、両者間隙を充填する方法、いわゆるコンプレッションフローでもよい。また、封止樹脂８は、液状でなく、いわゆる、Ｂステージの固形でもよい。

【００３５】ここで、接続電極５に施された凹み６に隙間が存在する場合は、その隙間にも封止樹脂８を浸透させるのが好ましい。かかる好ましい理由は、突起電極３と接続電極５に施された凹み６との間の遊びがなくなり、せん断力に対してより強固な構造となるからである。

【００３６】このように、半導体素子１の突起電極３を、回路基板４の接続電極５の凹み６に、嵌め込み係合させて搭載するので、特に封止樹脂８の硬化のための熱処理の際の半導体素子１と回路基板４との熱膨張係数の差に起因するせん断応力に対して、突起電極３と接続電極５の凹み６との嵌め込みによる強固な構造が、せん断歪みを抑制し、これによって、従来生じていた導通不良を低減して接続信頼性を高めることができる。

【００３７】（実施の形態２）図２は、本発明の他の実施の形態に係る実装方法を説明するための図１に対応する断面図であり、図１に対応する部分には、同一の参照符号を付す。

【００３８】この実施の形態では、先ず、同図（ａ）のように、半導体素子１の端子電極２に突起電極３を形成する。この突起電極３は、ワイヤボンド装置やめっきなどで形成された金属導電物である。

【００３９】一方、同図（ｂ）のように、接続電極５の突起電極３が当接する位置に凹み６が形成された回路基板４を準備する。さらに、凹み６に、導電性接着剤７を、例えば、印刷等によって埋め込んでおく。

【００４０】次に、同図（ｃ）に示されるように、突起電極３の形成された半導体素子１を、接続電極５に凹み６を有する回路基板４の所定の位置に正確に実装されるよう位置合わせを行なって、すなわち、半導体素子１の突起電極３を、回路基板４の接続電極５の凹み６に嵌り込ませて搭載するのである。

【００４１】この実施の形態では、突起電極３の径と接続電極５に施された凹み６の径が一致しない場合、突起電極３搭載時において、導電性接着剤７が変形することにより、径の相違による隙間に導電性接着剤７が入り込み、せん断力に対してより強固な構造となる。

【００４２】次に、同図（ｄ）に示されるように、半導体素子１と回路基板４との間隙に封止樹脂８を注入し、例えば、１５０℃２時間程度で硬化させる。

【００４３】その他の構成および効果は、上述の実施の形態１と同様である。

【００４４】（実施の形態３）図３は、本発明の他の実施の形態に係る実装方法を説明するための図１に対応する断面図であり、図１に対応する部分には、同一の参照符号を付す。

【００４５】この実施の形態では、先ず、同図（ａ）のように、半導体素子１の端子電極２に突起電極３を形成する。この突起電極３は、ワイヤボンド装置やめっきなどで形成された金属導電物である。さらに、この突起電極３には、その表面に導電性接着剤７の層が形成される。

【００４６】一方、同図（ｂ）のように、接続電極５の突起電極３が当接する位置に凹み６が形成された回路基板４を準備する。

【００４７】次に、同図（ｃ）に示されるように、突起電極３の形成された半導体素子１を、接続電極５に凹み６を有する回路基板４の所定の位置に正確に実装されるよう位置合わせを行なって、すなわち、半導体素子１の突起電極３を、回路基板４の接続電極５の凹み６に嵌り込ませて搭載するのである。

【００４８】この実施の形態では、突起電極３の径と接続電極５に施された凹み６の径が一致しない場合、突起電極３搭載時において、導電性接着剤７が変形することにより、径の相違による隙間に導電性接着剤７が入り込み、せん断力に対してより強固な構造となる。

【００４９】次に、同図（ｄ）に示されるように、半導体素子１と回路基板４との間隙に封止樹脂８を注入し、例えば、１５０℃２時間程度で硬化させる。

【００５０】その他の構成および効果は、上述の実施の形態１と同様である。

【００５１】（実施の形態４）図４は、本発明の他の実施の形態に係る実装方法を説明するための図１に対応する断面図であり、図１に対応する部分には、同一の参照符号を付す。

【００５２】この実施の形態では、先ず、同図（ａ）のように、半導体素子１の端子電極２に突起電極３を形成する。この突起電極３は、ワイヤボンド装置やめっきなどで形成された金属導電物である。さらに、この突起電極３には、その表面に導電性接着剤７の層が形成される。

【００５３】一方、同図（ｂ）のように、接続電極５の突起電極３が当接する位置に凹み６が形成された回路基板４を予め準備し、さらに、凹み６に、導電性接着剤７を埋め込んでおく。

【００５４】次に、同図（ｃ）に示されるように、突起電極３の形成された半導体素子１を、接続電極５に凹み６を有する回路基板４の所定の位置に正確に実装されるよう位置合わせを行なって、すなわち、半導体素子１の突起電極３を、回路基板４の接続電極５の凹み６に嵌り込ませて搭載するのである。

【００５５】この実施の形態では、突起電極３の径と接続電極５に施された凹み６の径が一致しない場合、突起電極３搭載時において、突起電極３あるいは凹み６の導電性接着剤７が変形することにより、径の相違による隙間に導電性接着剤７が入り込み、せん断力に対してより強固な構造となる。

【００５６】次に、同図（ｄ）に示されるように、半導体素子１と回路基板４との間隙に封止樹脂８を注入し、例えば、１５０℃２時間程度で硬化させる。

【００５７】その他の構成および効果は、上述の実施の形態１と同様である。

【００５８】（その他の実施の形態）上述の各実施の形態では、突起電極３は、一段の突起であったけれども、本発明の他の実施の形態として、突起電極は、図５の従来例のような二段の突起であってもよく、この場合には、先端の突起に係合する凹みあるいは壁部を、回路基板の接続電極に形成すればよい。

【００５９】上述の各実施の形態では、接続電極５には、凹み６が形成されたけれども、本発明の他の実施の形態として、凹み６に代えて、突起電極３の周壁の少なくとも一部に当接係合してせん断応力に抗するような壁部を形成してもよい。すなわち、凹み６は、壁部が周方向に連続して全周に亘って形成されたものとして把握することができる。また、壁部は、接続電極５を貫通して回路基板６に至るものであってもよく、例えば、凹み６を、接続電極５を貫通する貫通孔とし、その内壁を壁部としてもよい。

【００６０】なお、本発明は、半導体素子の実装に限らず、例えば、ＳＡＷフィルターのようにベアチップ実装するその他の電子部品素子の実装に適用できるものである。

【００６１】

【発明の効果】以上のように本発明によれば、高温時の電子部品素子と回路基板との熱膨張係数の差に起因するせん断応力に対して、突起電極と接続電極の壁部あるいは凹みとの係合による強固な構造としてせん断歪みを抑制することができ、これによって、電子部品素子と回路基板との熱膨張係数の差に起因するせん断歪みによって生じていた従来の導通不良を低減して接続信頼性を高めることができる。

【図面の簡単な説明】

【図１】本発明の実施の形態１に係る半導体素子の実装工程の断面図である。

【図２】本発明の実施の形態２に係る半導体素子の実装工程の断面図である。

【図３】本発明の実施の形態３に係る半導体素子の実装工程の断面図である。

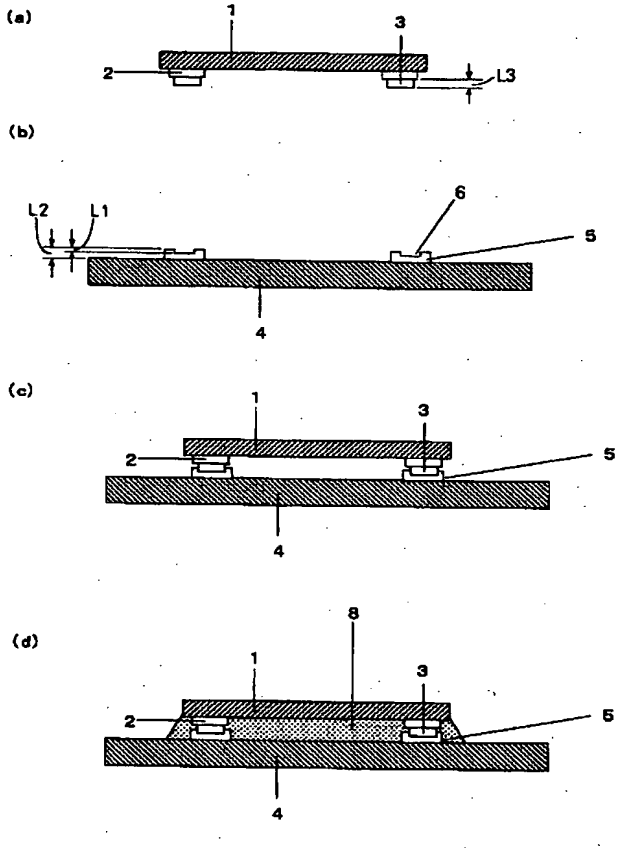
【図４】本発明の実施の形態４に係る半導体素子の実装工程の断面図である。

【図５】従来の半導体素子の実装工程の断面図である。

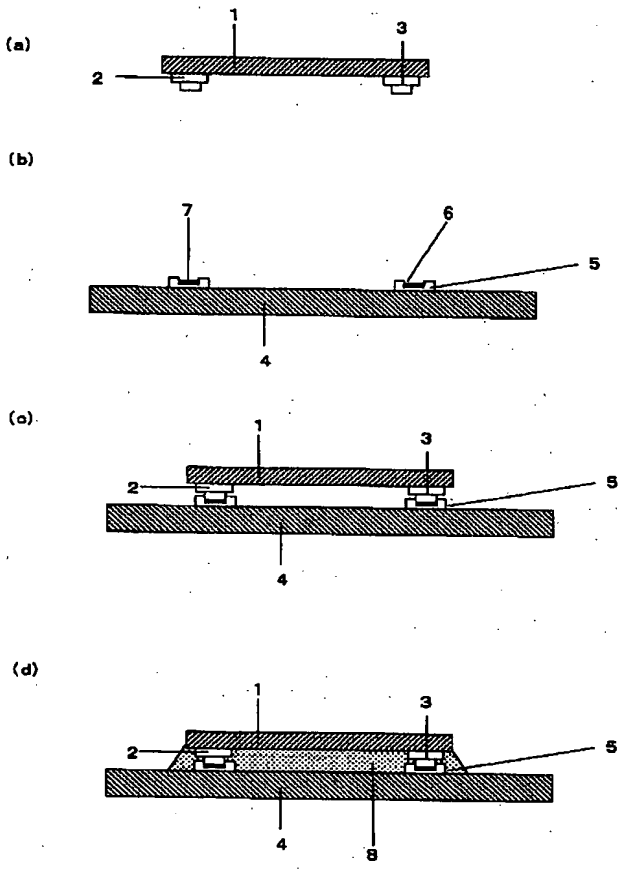
【符号の説明】

1 半導体素子
2 端子電極
3 突起電極
4 回路基板
5 接続電極
6 凹み
7 導電性接着剤
8 封止樹脂

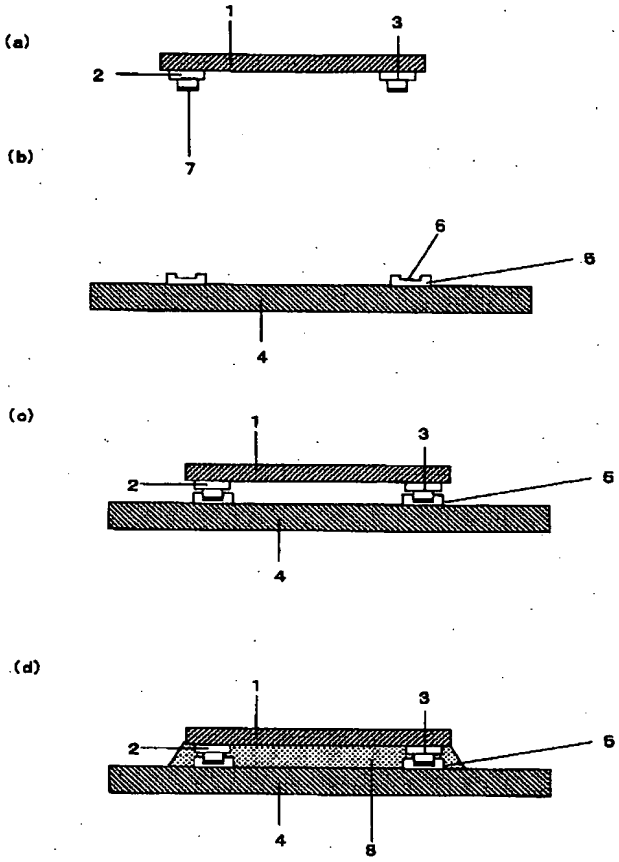
【図１】



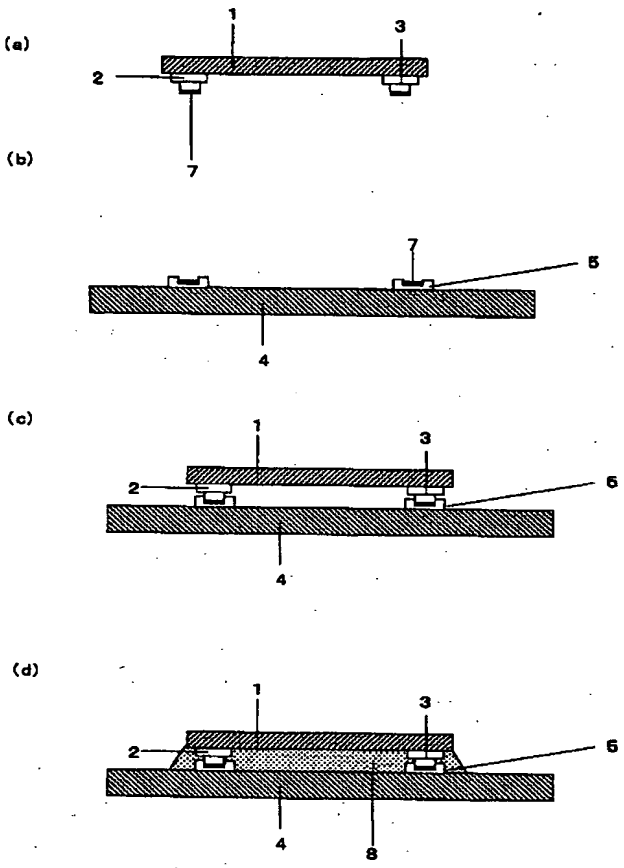
【図２】



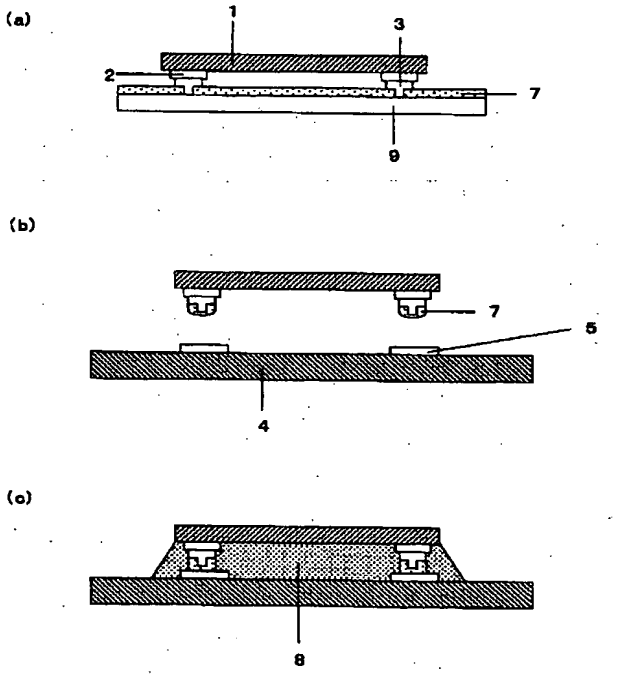
【図3】


(a)
1
2
3
7
(b)
6
5
4
(c)
1
2
3
5
4
(d)
1
2
3
5
4
8

【図4】


(a)
1
2
3
7
(b)
7
5
4
(c)
1
2
3
5
4
(d)
1
2
3
5
4
8

【図5】


(a)
1
2
3
7
9
(b)
7
5
4
(c)
8

フロントページの続き

(51)Int.Cl.[7]	識別記号	FI	テーマコード(参考)
		H01L 21/92	602G

(72)発明者 板垣 峰広
大阪府門真市大字門真1006番地 松下電器産業株式会社内

Fターム(参考) 5E319 AA03 AB05 AC01 AC11 AC12 CC12 CC61 CD26
5E336 AA04 BB01 CC32 CC58 EE08 GG11
5F044 KK17 LL07 LL11 QQ02